

REMARKS/DISCUSSION OF ISSUES

Claims 1-13 are pending in the application.

Reexamination and reconsideration are respectfully requested in view of the following Remarks.

35 U.S.C. § 103

The Office Action rejects: claims 1-4 and 6-13 under 35 U.S.C. § 103 over Bertrum et al. U.S. patent application publication 2003/0042850 ("Bertrum") in view of Bulovic et al. U.S. patent application publication 2004/0023010 ("Bulovic"); and claim 5 under 35 U.S.C. § 103 over Bertrum and Bulovic in view of Lin et al. U.S. patent application publication 2003/0099860 ("Lin")

Applicants respectfully traverse these rejections for at least the following reasons.

At the outset, Applicants rely upon at least the following standards with respect to a proper rejection under 35 U.S.C. § 103.

First, the Examiner must establish the level of ordinary skill in the art of the invention. M.P.E.P. §§ 2141(II)(C) and 2141.03. Second, the prior art relied upon, coupled with the knowledge generally available in the art at the time of the invention, requires some reason that the skilled artisan would modify a reference or to combine references. Princeton Biochemicals, Inc. v. Beckman Coulter, Inc., 411 F.3d 1332 (Fed. Cir. 2005). Also, a rejection on obviousness grounds under 35 U.S.C. § 103 cannot be sustained by mere conclusory statements: instead there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. In re Kahn, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). See also KSR International Co. v. Teleflex Inc., 550 U.S. 398, 82 USPQ2d 1385, 1396 (2007) (quoting Federal Circuit statement with approval). See M.P.E.P. § 2141(III). Second, there must be a reasonable expectation of success. "*The mere fact that references can be combined or modified does not render the resultant combination obvious unless the results would have been predictable to one of ordinary skill in the art.*" M.P.E.P. § 2143.01(III) (citing KSR International Co. v.

Teleflex Inc., 82 USPQ2d 1385, 1396 (2007)). Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. “*All words in a claim must be considered in judging the patentability of that claim against the prior art.*” M.P.E.P. § 2143.03 (citing In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970)). An integral part of this analysis requires establishing the level of ordinary skill in the art of invention. See M.P.E.P. §§ 2141(II)(C) and 2141.03.

Claim 1

Among other things, the method of claim 1 includes a synergistic series of steps, including: (1) supplying electrons and holes to the organic matrix of electroluminescent organic molecules; (2) generating in electroluminescent organic molecules of an organic matrix excited states in the form of excitons in response to supplied electrons and hole; (3) transferring excitons from the electroluminescent organic molecules to the transfer molecules on the quantum dots; and (4) transferring excitons from the transfer molecules to the quantum dots.

Applicants respectfully submit that no combination of the teachings of the cited references discloses or suggests any method that includes this combination of features.

For example, none of the references discloses or suggests the single step of transferring excitons from electroluminescent organic molecules to transfer molecules on the quantum dots. The Office Action fairly admits that Bertram does not even disclose any electroluminescent organic molecules in its device. Therefore of course it also could not (and does not) disclose any method that could transfer excitons from electroluminescent organic molecules to transfer molecules on the quantum dots.

The Office Action does not allege that Bulovic teaches or suggests transferring excitons from electroluminescent organic molecules to transfer molecules on quantum dots. Indeed, Applicants see no such disclosure anywhere in Bulovic.

So it is apparent that Bulovic cannot supply the features that are not taught by Bertram, and therefore no possible combination of Bertram and Bulovic could produce the method of claim 1 that transfers excitons from electroluminescent

organic molecules to transfer molecules on quantum dots.

The Office Action states that Bulovic discloses dispersing nanocrystals in an HTL matrix, and that it would be obvious to have modified Bertram's **device** to have replaced Bertram's organic matrix with an HTL matrix to improve the conduction and reduce the number of pinhole shorts in the emissive layer.

First, even assuming *arguendo* that this was true, this still does not teach a **method** where excitons **generated by electroluminescent organic molecules** are transferred to transfer molecules on quantum dots.

Furthermore, Applicants respectfully traverse the proposed combination. Bulovic only teaches that dispersing nanocrystals in a HTL “*circumvents relatively poor conduction observed in nanocrystal solids, [and] can also reduce the number of pinhole shorts in the nanocrystal layer.*” So it is seen that the benefits which the Office Action proposes as reasons to modify Bertram's device, are provided only when a nanocrystal solid is replaced with nanocrystals dispersed in a matrix. However Bertram's nanocrystals are **already** embedded in a matrix (paragraph [0029])! So these supposed “benefits” to modifying Bertram would not apply.

In short, nothing in Bulovic provides any suggestion for modifying Bertram's method such that excitons generated by electroluminescent organic molecules are transferred to transfer molecules on quantum dots.

Therefore, for at least these reasons, Applicants respectfully submit that claim 1 is patentable over the cited art. Accordingly, Applicants respectfully request that the rejection of claim 1 be withdrawn, and that claim 1 be allowed at this time.

Claims 2-4 and 6-7

Claims 2-4 and 6-7 depend from claim 1 and are deemed patentable for at least the reasons set forth above with respect to claim 1, and for the following additional reasons.

Claim 4

Among other things, the method of claim 4 includes providing transfer molecules which have a bandgap, E_{transfer} , which is smaller than a bandgap, $E_{\text{org. mol.}}$, of the electroluminescent organic molecules and larger than a bandgap, E_{QD} , of the

quantum dots.

As discussed above, Bertrum does not disclose any arrangement that includes a combination of quantum dots embedded in electroluminescent organic molecules, and therefore also cannot disclose an arrangement where transfer molecules have a bandgap, E_{transfer} , which is smaller than a bandgap, $E_{\text{org. mol.}}$, of electroluminescent organic molecules and larger than a bandgap, E_{QD} , of quantum dots.

Therefore, for at least these additional reasons, Applicants respectfully submit that claim 4 is patentable over Bertrum.

Claim 6

Among other things, in the method of claim 6 a transfer rate of excitons from electroluminescent organic molecules to transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules.

As discussed above, Bertrum does not disclose any single device that includes a combination of quantum dots having transfer molecules on their surfaces embedded in electroluminescent organic molecules, and therefore also cannot disclose an arrangement where a transfer rate of excitons from electroluminescent organic molecules to transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules.

Therefore, for at least these additional reasons, Applicants respectfully submit that claim 6 is patentable over Bertrum.

Accordingly, Applicants respectfully request that the rejections of claims 3, 4 and 6-7 be withdrawn, and claims 3, 4 and 6-7 be allowed.

Claim 8

Among other things, the device of claim 8 includes an organic matrix of electroluminescent organic molecules embedded with quantum dots, wherein a quantum dot has one or more transfer molecules attached to its surface for receiving excitons generated in the electroluminescent organic molecules and transferring received excitons to the quantum dot.

For similar reasons to those set forth above with respect to claim 1, Applicants respectfully submit that the cited art, alone or collectively, does not disclose any

device including this combination of features.

Also among other things, in the device of claim 8 a transfer rate of excitons from the electroluminescent organic molecules to the transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules.

The Office Action makes no mention of this feature. Instead, the Office Action states that “*claim 8 recites essentially the same limitations as of claim 1.*” However, claim 1 does not recite that a transfer rate of excitons from the electroluminescent organic molecules to the transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules. So claim 8 could not be rejected for the same reasons as claim 1. Furthermore, Applicants respectfully submit that the cited art does not suggest any device that includes quantum dots having transfer molecules on their surfaces embedded in electroluminescent organic molecules, and therefore also cannot disclose an arrangement where a transfer rate of excitons from electroluminescent organic molecules to transfer molecules is larger than a decay rate of excitons in the electroluminescent organic molecules.

Therefore, for at least these reasons, Applicants respectfully submit that claim 8 is patentable over the cited art. Accordingly, Applicants respectfully request that the rejection of claim 8 be withdrawn, and that claim 8 be allowed.

Claims 9-10

Claims 9-10 depend from claim 8 and are deemed patentable for at least the reasons set forth above with respect to claim 8. Accordingly, Applicants respectfully request that the rejections of claims 9-10 be withdrawn, and claims 9-10 be allowed.

Claim 11

Among other things, the method of claim 11 includes providing a solution comprising a plurality of quantum dots with one or more transfer molecules attached to the surfaces, the transfer molecules having a bandgap, E_{transfer} , which is smaller than a bandgap, $E_{\text{org. mol.}}$, of the electroluminescent organic molecules and larger than a bandgap, E_{QD} , of the quantum dots, mixing the electroluminescent organic molecule solution with the quantum dot solution, and forming a matrix of electroluminescent organic molecules with embedded quantum dots.

Applicants respectfully submit that the prior art does not disclose or suggest any method that includes this combination of features.

Applicants respectfully submit that no combination of Bertrum and Bulovic could ever produce the method of claim 11. In particular, Applicants respectfully submit that there is nothing in Bertrum and Bulovic that would have provided a reason for one of ordinary skill in the art at the time of the invention to have provided a plurality of electroluminescent organic molecules in solution, provided a solution comprising a plurality of quantum dots with one or more transfer molecules attached to the surfaces, the transfer molecules having a bandgap, E_{transfer} , which is smaller than a bandgap, $E_{\text{org. mol.}}$, of the electroluminescent organic molecules and larger than a bandgap, E_{QD} , of the quantum dots, and mixed the electroluminescent organic molecule solution with the quantum dot solution. Indeed, Applicants respectfully submit that none of the references teach any arrangement which includes a combination of electroluminescent organic molecules and quantum dots with one or more transfer molecules attached to the surfaces.

Therefore, for at least these reasons, Applicants respectfully submit that claim 11 is patentable over the cited art. Accordingly, Applicants respectfully request that the rejection of claim 11 be withdrawn, and claim 11 be allowed.

Claims 12-13

Claims 12-13 depend from claim 11 and are deemed patentable for at least the reasons set forth above with respect to claim 11. Accordingly, Applicants respectfully request that the rejections of claims 12-13 be withdrawn, and claims 12-13 be allowed.

Claim 5

Claim 5 depends from claim 1. Applicants respectfully submit that Lin does not remedy the deficiencies of Bertrum and Bulovic as set forth above with respect to claim 1. Therefore, claim 5 is deemed patentable for at least the reasons set forth above with respect to claim 1.

CONCLUSION

In view of the foregoing explanations, Applicants respectfully request that the Examiner reconsider and reexamine the present application, allow claims 1-13 and pass the application to issue. In the event that there are any outstanding matters remaining in the present application, the Examiner is invited to contact Kenneth D. Springer (Reg. No. 39,843) at (571) 283.0720 to discuss these matters.

Respectfully submitted,

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